

*Bishop 57-17-4-19-14-18
Serial No. 10/786,199*

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Remarks

Extension of Time

Accompanying this response is a petition extending time for response by one (1) month from July 19, 2006 to August 19, 2006.

Amendments

The specification has been amended at page 1 to correct an inadvertent transposition of the labeling of the HVP and LVP substances. The change renders page 1 consistent with the remainder of the specification (e.g., page 4, lines 1-15) and claims (e.g., Claim 1, lines 10-13), both of which labeled these substances correctly; that is, the concentration of the HVP substance evaporated into the ambient is increased, and the concentration of the LVP substance remaining in the channel is also increased.

Accordingly, it should be clear that no new matter has been added.

Restriction

Applicants hereby affirm their election without traverse to prosecute the invention of Group I (Claims 1-11). However, Applicants disagree with the Examiner's statement in paragraph 2, as follows: "in group I, the two substances constantly intermingle as the gas inevitably condenses into the fluid." To the contrary, the high vapor pressure first substance passes from the fluid in the channel into the ambient; it does not condense back into the fluid.

Summary of the Invention

Before discussing the rejection on the merits, it will be helpful to briefly review Applicants' invention.

In one aspect of Applicants' invention, as set forth in Claim 1, a micro-fluidic elongated channel is formed in a substrate, the channel being in fluid-flow communication with an ambient region along its elongated dimension. An input port introduces a fluid into the channel and an output port extracts fluid from the channel. The fluid comprises a high vapor pressure (HVP)

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first substance and a low vapor pressure (LVP) second substance. An evaporation controller is configured to increase the evaporation rate of the fluid from the channel into the ambient region so that two concentration-increasing effects take place: (i) the concentration of the LVP second substance in the portion of the fluid remaining in the channel is increased; and (ii) the concentration of the HVP first substance in the portion of said fluid evaporated into the ambient region is also increased.

In one embodiment of Applicants' invention, as set forth in Claims 2-3, the ambient region is formed within a collection chamber, and the evaporated portion of the HVP first substance is condensed therein.

In another embodiment of Applicants' invention, as set forth in Claims 4-5, a gas-permeable membrane is disposed between the channel and the ambient region. The membrane confines the fluid to the channel but allows the evaporated HVP first substance to flow therethrough to the ambient region.

Importantly, Applicants' invention addresses a significant problem with chemicals that are perishable and reactive and have a limited shelf life, such as high molar H_2O_2 . A low molar concentration of H_2O_2 is desirable because in this form the chemical is more durable and transportable, as well as safer than at higher molar concentrations. For many applications, where a higher molar concentration of H_2O_2 is needed, it is desirable to convert a low molar concentration to a high molar concentration at or near the time when the chemical is to be used. Applicants' invention enables the concentration of aqueous H_2O_2 to be increased, as described a page 7, lines 13 *et seq.* of the specification.

Claim Rejections – 35 USC 102

Claims 1-2, 6-7 and 10-11 have been rejected under 35 USC 102(b) as being anticipated by U. Bonne *et al.*, US Patent No. 6,393,894 (hereinafter *Bonne*). The Examiner states her position as follows:

...In Figure 1, Bonne discloses an apparatus comprising a substrate 12, a micro-fluidic elongated channel 32 formed on the substrate, an input port 34 and an output port 36 and an evaporation controller 14 comprising a heater 20, 22, 24, 26 coupled to the substrate. The controller operates the heater in a pulsed mode (column 3 lines 1-11). Figure 6 discloses a collection chamber 126.

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In Figure 9, the elongated channel has a serpentine shape. The surfaces of the channel contain a coating (column 4 lines 31-41).

This rejection is respectfully traversed for the reasons set forth below.

- (1) **Anticipation:** The law of anticipation under Section 102 is clear, as set forth in MPEP 2131: "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ...claim." *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Each and every element of Applicants' claims is not found in Bonne, as discussed below.
- (2) **Evaporation Controller:** Applicants' invention requires an evaporation controller configured to have two concentration-increasing effects; that is, (i) the concentration of the LVP second substance in the portion of the fluid remaining in the channel is increased; and (ii) the concentration of the HVP first substance in the portion of said fluid evaporated into the ambient region is also increased. In contrast, Bonne's controller 14 is *not* configured to control evaporation; it is configured to control adsorption and desorption. More specifically, Bonne describes sensor apparatus 10 having a fluid channel 32 with a plurality of interactive (sorbent) elements 40-46 and corresponding heater elements 20-26 arranged in tandem along the channel. The interactive elements adsorb certain constituents of the fluid. The controller 14 sequentially heats the heater elements 20-26, thereby causing the interactive elements to desorb the constituents back into the fluid in a timed, pulsed fashion (FIG. 3). Controller 14 times the sequential desorption so that concentrated pulses 70-82 grow from the input port 34 to the output port 36. The concentrated constituents are at all times contained within the channel until they exit output port 36. At no time is evaporation of any fluid constituent employed to increase the concentration of that constituent. Rather, controller 14 is configured to control an adsorption/desorption

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process to increase the concentration of certain constituents in the fluid.

- (3) **HVP and LVP Substances:** Applicants' invention requires that the evaporation controller has *two* concentration-increasing effects: (i) the concentration of the LVP second substance in the portion of the fluid remaining in the channel is increased; and (ii) the concentration of the HVP first substance in the portion of said fluid evaporated into the ambient region is also increased. In contrast, Bonne's controller is not described as operating on both a LVP substance and a HVP substance in the fluid. Vapor pressure is not an issue in Bonne's sensor apparatus since evaporation is not the physical/chemical mechanism on which it relies. Consequently, it is clear that Bonne's controller does not increase the concentration of a HVP first substance in the portion of the fluid evaporated into the ambient region, since no such evaporation takes place.
- (4) **Channel-Ambient Coupling:** Applicants' Claim 1, lines 4-5, requires that the channel is in fluid-flow communication with the ambient *along the length of the channel*. In contrast, in Bonne channel 32 is not in fluid-flow communication with the ambient anywhere along the length of the channel. Rather, channel 32 is completely enclosed except at the ends where it is coupled to input and output ports 34 and 36, respectively.
- (5) **Collection Chamber:** Applicants' Claim 2 requires a collection chamber that includes the ambient region, which, as set forth in Claim 1, is the region into which the HVP substance evaporates. The Examiner asserts, "Figure 6 discloses a collection chamber 126," but the latter does not collect an HVP substance that has evaporated from the channel. Rather, it simply receives the fluid, along with the concentrated pulses, that exits from output port 36 (FIG. 1).
- (6) **Dependent Claims:** Claims 6-7 and 10-11 are patentable by virtue of their dependence on Claim 1 for the reasons advance above and incorporated herein by reference.
- (7) **Functional Language:** In formulating her Section 102 rejection, the Examiner made a curious omission – she failed to address the language of Claim 1, lines 9-13, which

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describes how the evaporation controller is configured. Moreover, she made no mention as to why this omission might be appropriate. Indeed, it was not. Assuming, *arguendo*, that the Examiner considered the language of Claim 1, lines 9-13, to be merely *functional* and to be accorded no patentable weight, Applicants submit that such an approach under Section 102 would contravene well-established principles; to wit, black letter law clearly indicates that such functional language must be given patentable weight. *In re Swinehart*, 169 USPQ 226 (CCPA 1971). More specifically, for over three decades the role of functional language in claims has followed *Swinehart*, where the CCPA held:

We take the characterization "functional"...to indicate nothing more than the fact that an attempt is being made to define something...by what it does rather than by what it is...In our view, there is *nothing intrinsically wrong* with the use of such a technique in drafting patent claims. (emphasis added)

When the language of Claim 1, lines 9-13 is accorded its due patentable weight, it is clear that Bonne fails to describe both the claimed evaporation controller and the invention as a whole.

Accordingly, it is respectfully submitted that Claims 1-2, 6-7 and 10-11 are not anticipated by Bonne.

Claim Rejections – 35 USC 103 (Claims 3-5)

Claims 3-5 have been rejected under 35 USC 103(a) as being unpatentable over Bonne in view of J. E. Fish *et al.*, US Patent No. 6,827,080 (hereinafter, *Fish*). In support of this rejection the Examiner states her position as follows:

Bonne does not disclose a gas-permeable, liquid impermeable membrane disposed between the channel and the ambient region or a means for condensing the gas that is collected from the sample fluid. Fish discloses a gas permeable and liquid impermeable membrane that separates a fluid from its evaporated gases (paragraph bridging columns 9 and 10) and prevents gas that has condensed from traveling back through the membrane (paragraph bridging columns 9 and 10). Fish teaches a means of condensing gas such as cooling (column 9 lines 25-65). An advantage of using a gas permeable, liquid impermeable membrane and cooling means in an apparatus is that it

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separates the gas from the liquid components and, additionally, when the gas is separated from the liquid components, separate reactions or processes with the liquid or the gas can be carried out (column 2 line 47-column 3 line 10). It would have been obvious...to modify the...Bonne concentration apparatus with the teachings of Fish to employ a gas permeable, liquid impermeable membrane in order to gain the advantages of isolating gas from liquid components and subsequently conducting separate reactions.

This rejection is respectfully traversed for the reasons set forth below:

- (1) **Claims 3-5:** Claim 3, which depends from Claim 1, requires means for condensing the portion of the first substance that is evaporated into the ambient region and is collected by a collection chamber that includes the ambient region. On the other hand, Claim 4 requires a gas-permeable membrane disposed between the channel and the ambient region. The membrane confines the fluid to the channel but allows the evaporated first substance to flow to the ambient region. Claim 5 requires that the membrane comprises a polymer or a porous organic solid.
- (2) **Bonne:** Bonne is defective for the reasons set forth in the Section 102 traverse of Claim 1, which is incorporated herein by reference. As discussed below, the Fish reference fails to correct those defects.
- (3) **Gas-Permeable Membrane:** Applicants' Claim 4 requires a gas-permeable membrane disposed between the channel and the ambient region. In contrast, the Abstract of Fish describes a *reaction* vessel constructed of two reactant chambers containing *two isolated reactants*. The chambers are separated by a frangible seal that opens under pressure, allowing the *reactants* to mix and *react*. The reaction produces a desired effect (e.g., heating, foaming) of an article (e.g., a pre-moistened towelette) in proximity to the reaction. In one embodiment (column 6, line 48 *et seq.*), when the reaction produces a gas, at least one reaction chamber includes a gas-permeable membrane. The gas escapes through the gas-permeable membrane. The reactants in this case may be solids, liquids or combinations of them (column 6, lines 60-63), but when liquids are used, the membrane is also liquid-impermeable. (column 6, lines 63-67). The key point is that Fish relates to *reactions between two isolated reactants*, and he uses a gas-permeable membrane only when the reaction produces a gas. On the other hand, Bonne's sensor apparatus involves no reactions between

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reactants, isolated or otherwise. And, Bonne certainly involves no reactions that generate gas with which a gas-permeable membrane might be used. Rather, Bonne simply involves the adsorption and desorption of constituents of a fluid. The adsorption and desorption processes do not involve reactions, as that well-known term is used in chemistry. Moreover, the Examiner points to a purported advantage of a gas-permeable membrane - to separate a gas from a liquid. However, in Bonne constituents in the fluid are adsorbed into the interactive (sorbent) elements and then desorbed back into the fluid before for the purpose of concentrating the constituent at periodic locations along the length of the channel (e.g., FIG. 3). No reactions take place; only concentration. Yet, the motivation for combining these two references cited by the Examiner is "to gain the advantages of isolating gas from liquid and subsequently conducting separate reactions." To the contrary, Bonne does not involve isolating a gas from a liquid - the constituent adsorbed from Bonne's fluid in one phase of the controller is desorbed back into the fluid in the next phase to effect concentration of the constituent at the detector. In addition, the notion that such separation allows subsequent separate reactions is not consistent with Bonne, which involves no reactions and whose only objective is to concentrate certain constituents in the fluid.

- (4) **Condensing Means:** Applicants' Claim 3 requires "means for condensing the portion of the first substance that is [evaporated from the fluid in the channel and] collected in said chamber." In contrast, the Examiner points to column 9, lines 25-65 of Fish as teaching "means for condensing gas such as cooling..." However, Applicants' reading of this section of Fish reveals only a statement that "endothermic reactions...can cool *the article...*" (column 9, lines 42 *et seq.*). No mention is made of condensing gas by cooling; cooling is described only as a means for cooling article 104; and gas is described only as entering a reactant chamber to produce foaming. Therefore, it is respectfully submitted that one skilled in the art would not be motivated by Fish to apply an endothermic reaction to Bonne's sensor apparatus; nor would one skilled in the art be motivated by Fish to condense gas in the manner

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required by Applicants' Claim 3.

- (5) **Membrane Material:** Applicants' Claim 5 requires that the gas-permeable membrane comprises a polymer or a porous inorganic solid. The Examiner is silent on this issue, having made no assertion that this feature of Applicants' invention is taught or reasonably suggested by any of the art of record.
- (6) **Improper Combination:** For the reasons discussed above, it is respectfully submitted that the combination of Bonne and Fish, as applied by the Examiner, is improper and fails to make out a *prima facie* case of obviousness of Claims 3-5 under Section 103.

Claim Rejections – 35 USC 103 (Claims 8-9)

Claims 8-9 have been rejected under 35 USC 103(a) as being unpatentable over Bonne in view of T. Kempe, US Patent No. 5,897,838 (hereinafter, *Kempe*). These claims are patentable by virtue of their dependence from Claim 1 for the reasons set forth above and incorporated herein by reference.

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